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मानक

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Mazdoor Kisan Shakti Sangathan

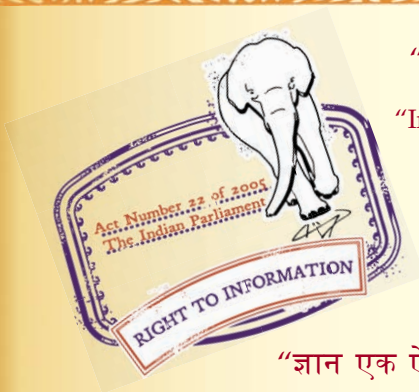
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IS 11000-2-1 (2008): Fire hazard testing, Part 2: Test methods, Section 1: Glow-wire apparatus and common test procedure [LITD 1: Environmental Testing Procedure]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
अग्नि जोखिम परीक्षण

भाग 2 परीक्षण विधियाँ

अनुभाग 1 चमकीला-तार उपकरण एवं सामान्य परीक्षण प्रक्रिया

(पहला पुनरीक्षण)

Indian Standard
FIRE HAZARD TESTING

PART 2 TEST METHODS

Section 1 Glow-Wire Apparatus and Common Test Procedure

(First Revision)

ICS 13.220.40; 29.020

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

NATIONAL FOREWORD

This Indian Standard (Part 2/Sec 1) (First Revision) which is identical with IEC 60695-2-10 : 2000 'Fire hazard testing — Part 2-10: Glowing/hot-wire based test methods — Glow-wire apparatus and common test procedure' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Environmental Testing Procedures Sectional Committee and approval of the Electronics and Information Technology Division Council.

This standard was first published in 1984. The first revision of this standard has been undertaken to align it with latest IEC Publication of IEC 60695-2-10 : 2000.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
- b) Comma (,) has been used as a decimal marker, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
IEC 60584-1 : 1995 Thermocouples — Part 1: Reference tables	IS 10625 : 1983 Reference tables for nickel/chromium-copper/nickel (chromel-constantan) thermocouples IS 12051 : 1987 Reference tables for nickel-chromium-silicon (Nicrosil/ Nisil) Type N thermocouples	Technically Equivalent
ISO 4046 : 1978 Paper, board pulp and related terms — Vocabulary	IS 4661 : 1999 Glossary of terms used in paper trade and industry	do

The technical committee responsible for the preparation of this standard has reviewed the provisions of the following International Standards referred in this standard and has decided that they are acceptable for use in conjunction with this standard:

<i>International Standard</i>	<i>Title</i>
IEC 60584-2 : 1982	Thermocouples — Part 2: Tolerances
IEC 60695-2-11 : 2000	Fire hazard testing — Part 2-11: Glowing/hot-wire based test methods — Glow-wire flammability test methods for end-products
IEC 60695-2-12 : 2000	Fire hazard testing — Part 2-12: Glowing/hot-wire based test methods — Glow-wire flammability test method for materials
IEC 60695-2-13 : 2000	Fire hazard testing — Part 2-13: Glowing/hot-wire based test methods — Glow-wire ignitability test method for materials
ISO/IEC 13943 : 2000	Fire safety — Vocabulary

(Continued on third cover)

Indian Standard

FIRE HAZARD TESTING

PART 2 TEST METHODS

Section 1 Glow-Wire Apparatus and Common Test Procedure

(First Revision)

1 Scope

This part of IEC 60695 specifies the glow-wire apparatus and common test procedure to simulate the effect of thermal stresses which may be produced by heat sources such as glowing elements or overloaded resistors, for short periods, in order to assess the fire hazard by a simulation technique.

The test described in this standard is applicable to electrotechnical equipment, its subassemblies and components, and may also be applied to solid electrical insulating materials or other solid combustible materials.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60695. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60695 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60584-1:1995, *Thermocouples – Part 1: Reference tables*

IEC 60584-2:1982, *Thermocouples – Part 2: Tolerances*

IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow wire flammability test methods for end-products*

IEC 60695-2-12:2000, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow wire flammability test method for materials*

IEC 60695-2-13:2000, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow wire ignitability test method for materials*

ISO 4046:1978, *Paper, board, pulp and related terms – Vocabulary*

ISO/IEC 13943:2000, *Fire safety – Vocabulary*

3 Definitions

For the purposes of this part of IEC 60695, the definitions given in ISO/IEC 13943, as well as the following definition, apply.

3.1

test temperature and temperature of the glow-wire

temperature to which the tip of the glow-wire is heated and stabilized prior to any contact with the test specimen

4 Outline of the test apparatus and common test procedure

This part of IEC 60695 specifies the glow-wire apparatus and common test procedure as a fire test using a non-flame ignition source.

The glow-wire is a specified loop of resistance wire, which is electrically heated to a specified temperature. The tip of the glow-wire is brought into contact with a test specimen for a specific period of time and a range of observations and measurements made, dependant upon the particular test procedure.

A detailed description of each test procedure is given in IEC 60695-2-11, IEC 60695-2-12 and IEC 60695-2-13.

5 Description of the test apparatus

5.1 Glow-wire

The glow-wire is made from nickel/chromium (80/20) wire, with an overall nominal diameter of 4 mm. The wire is formed into a loop as detailed in figure 1.

The glow-wire is heated by a simple electric circuit as shown in figure 2. There shall be no feedback mechanism or circuit to maintain the temperature.

Due to the high currents involved, it is essential that the electrical connections for the glow-wire are capable of carrying the current without affecting the performance or long-term stability of the circuit.

NOTE 1 The typical current necessary for heating the tip to a temperature of 960 °C is between 120 A and 150 A.

The test apparatus shall be so designed that the glow-wire is kept in a horizontal plane and that it applies a force of $1,0 \text{ N} \pm 0,2 \text{ N}$ to the test specimen during the application of the glow-wire. The force shall be maintained at this value when the glow-wire or the test specimen is moved horizontally one towards the other. The penetration of the tip of the glow-wire into and through the test specimen shall be limited to $7 \text{ mm} \pm 0,5 \text{ mm}$.

The test apparatus shall be so designed that burning or glowing particles falling from the test specimen are able to fall on the layer as specified in 5.3.

Two typical examples of the test apparatus are shown in figures 3a and 3b.

NOTE 2 The apparatus shown in figure 3b is used where heavy test specimens are being tested or where specimens are tested within the equipment.

5.2 Temperature measuring system

The temperature of the tip of the glow-wire shall be measured by a class 1 (see IEC 60584-2) mineral-insulated metal-sheathed fine-wire thermocouple with an insulated junction. It shall have an overall nominal diameter of 1,0 mm or 0,5 mm and wires of, for example, NiCr and NiAl (type K) (see IEC 60584-1) suitable for continuous operation at temperatures up to 960 °C with the welded point located inside the sheath as close to the tip as possible. The sheath shall consist of a metal resistant to continuous operation at a temperature of at least 1 050 °C. In case of dispute, the 0,5 mm thermocouple shall be used.

NOTE 1 A sheath made from a nickel-based heat-resistant alloy will satisfy the above requirements.

NOTE 2 It is the intention for a future revision of this standard that the reference to 0,5 mm thermocouples will be withdrawn.

The glow-wire, with the thermocouple, is shown in figure 1.

The thermocouple is arranged in a pocket hole, drilled in behind the tip of the glow-wire, and maintained as a close fit as shown in detail Z of figure 1. The thermal contact between the tip of the thermocouple and the end of the drilled hole shall be maintained. Care should be taken to ensure that the thermocouple is able to follow the dimensional changes of the tip of the glow-wire caused by heating.

The instrument for measuring the thermovoltages may consist of any commercial digital thermometer with a built-in reference junction.

NOTE 3 Other temperature-measuring instrumentation may be used, but, in case of dispute, the thermocouple method must be used.

5.3 Specified layer

To evaluate the possible spread of fire, for example by burning or glowing particles falling from the test specimen, a specified layer is placed underneath the test specimen.

Unless otherwise specified, a single layer of wrapping tissue, resting on, and in close contact with, the upper surface of a piece of flat smooth wooden board, having a minimum thickness of 10 mm, is positioned at a distance of 200 mm $\pm$ 5 mm below the place where the glow-wire is applied to the test specimen. See figures 3a and 3b.

Wrapping tissue, as specified in 6.86 of ISO 4046 is a soft and strong, lightweight wrapping tissue of grammage between 12 g/m² and 30 g/m².

The wrapping tissue may be replaced by other similar materials if they have been verified as equally suitable for the purpose.

NOTE The wrapping tissue is primarily intended for protective packaging of delicate articles and for gift wrapping.

5.4 Test chamber

The apparatus shall be operated in a draught-free condition. This can be achieved by using a chamber with a volume of at least 0,5 m³ which permits observation of the test specimen. The volume of the chamber shall be such that oxygen depletion during the test does not significantly affect the result. The test specimen shall be mounted at least 100 mm from any surface of the chamber. After each test, the chamber shall be vented to safely remove air containing degradation products. The ambient light falling on the test specimen, not counting the glow-wire, shall not exceed 20 lx and the background material shall be dark. The chamber shall be considered dark enough when the lux meter, facing towards the rear part of the chamber, is positioned in place of the test specimen and the level is less than 20 lx.

6 Verification of the apparatus

6.1 Verification of the glow-wire tip

Before each series of tests, it is necessary to inspect the glow-wire tip by measuring and recording dimension "A" as shown in figure 1, detail Z. This shall be compared with subsequent tests and when this dimension is reduced to 90 % of its initial reading then the glow-wire shall be replaced.

On completion of each test, it is necessary to clean the tip, if necessary, of any residue of previously tested material, for example, by means of a wire brush and then to inspect the tip of the glow-wire for any cracks.

6.2 Verification of the temperature measuring system

6.2.1 The continuous correct performance and calibration of the temperature measuring system described in 5.2 shall be verified periodically.

6.2.2 A one-point verification of the temperature of the glow-wire can be performed using a foil of silver with a purity of at least 99,8 %, approximately 2 mm² and 0,06 mm thick, placed upon the upper surface of the tip of the glow-wire. The glow-wire is heated at a suitably slow heating rate, and, when the foil starts to melt, the thermometer shall indicate 960 °C ± 15 °C. The glow-wire, while still hot, shall be cleared of all traces of silver immediately after this verification process to reduce the probability of alloying. In case of dispute, this verification method using a silver foil shall be used.

7 Conditioning

Before testing, the wooden board and wrapping tissue shall be stored for 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity between 45 % and 75 %.

8 Common test procedure

Warning note:

Precautions shall be taken to safeguard the health of personnel conducting tests against

- the risks of explosion, burning or fire;
- the risk of electric shock;
- the inhalation of smoke and/or toxic products;
- the toxic residues.

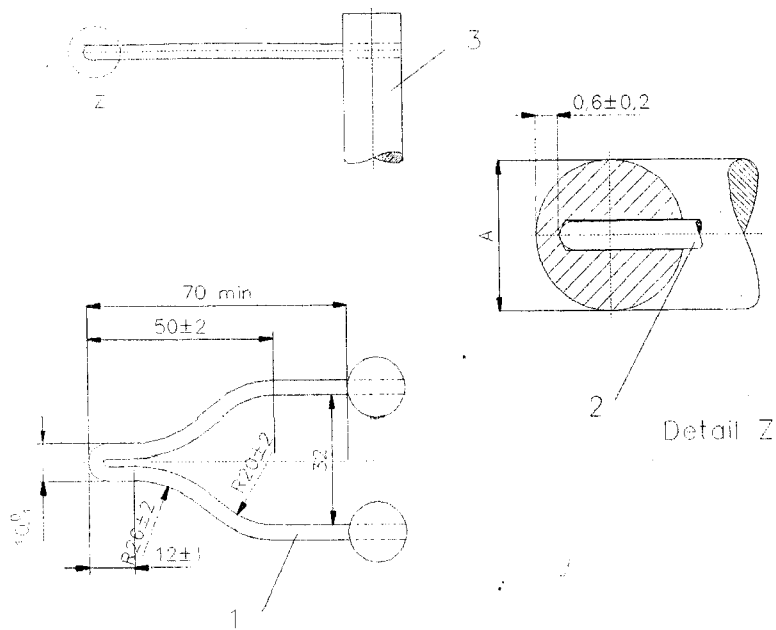
8.1 The test specimen shall be mounted or clamped so that

- a) the heat losses due to the supporting or fixing means are insignificant (see figure 4);
- b) the planar area of the surface is vertical;
- c) the tip of the glow-wire is applied to the centre of the planar area of the surface.

8.2 The glow-wire is heated to the specified temperature, which is measured by means of the calibrated temperature measurement system. Before bringing the tip of the glow-wire into contact with the test specimen, care shall be taken to ensure that

- a) this temperature is constant within 5 K for a period of at least 60 s;
- b) heat radiation does not influence the test specimen during this period by providing an adequate distance i.e. 5,0 cm minimum, or by using an appropriate screen;
- c) no further adjustment to the heating current or voltage is to be made until after the test is completed.

8.3 The tip of the glow-wire is then brought slowly into contact with the test specimen for $30 \text{ s} \pm 1 \text{ s}$. An approximate rate of approach and withdrawal of 10 mm/s to 25 mm/s has been found to be satisfactory. However, the rate of approach shall be reduced to near zero upon contact to avoid forces of impact exceeding $1,0 \text{ N} \pm 0,2 \text{ N}$. In those cases where the material melts away from the glow-wire, the glow-wire shall not be kept in contact with the test specimen. Following the application time, the glow-wire and the test specimen are slowly separated, avoiding any further heating of the test specimen and any movement of air which might affect the result of the test. The penetration of the tip of the glow-wire into and through the test specimen shall be limited to $7 \text{ mm} \pm 0,5 \text{ mm}$.



Dimensions in millimetres

Glow-wire material: Nickel/Chromium (80/20)
Diameter: 4,0 mm ± 0,04 mm (before bending)
Diameter A: (After bending) see 6.1

When forming the glow-wire loop, care shall be taken to avoid fine cracking at the tip.

NOTE Annealing is a suitable process for prevention of fine cracking at the tip.

Key

- 1 Glow-wire
- 2 Thermocouple
- 3 Stud

Figure 1 – Glow-wire and position of thermocouple

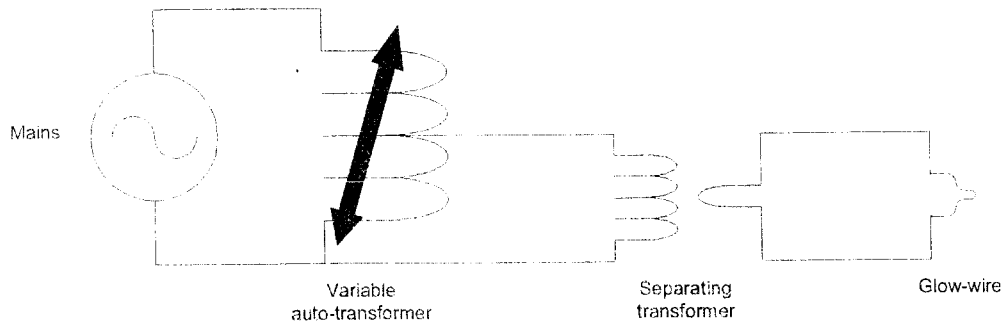
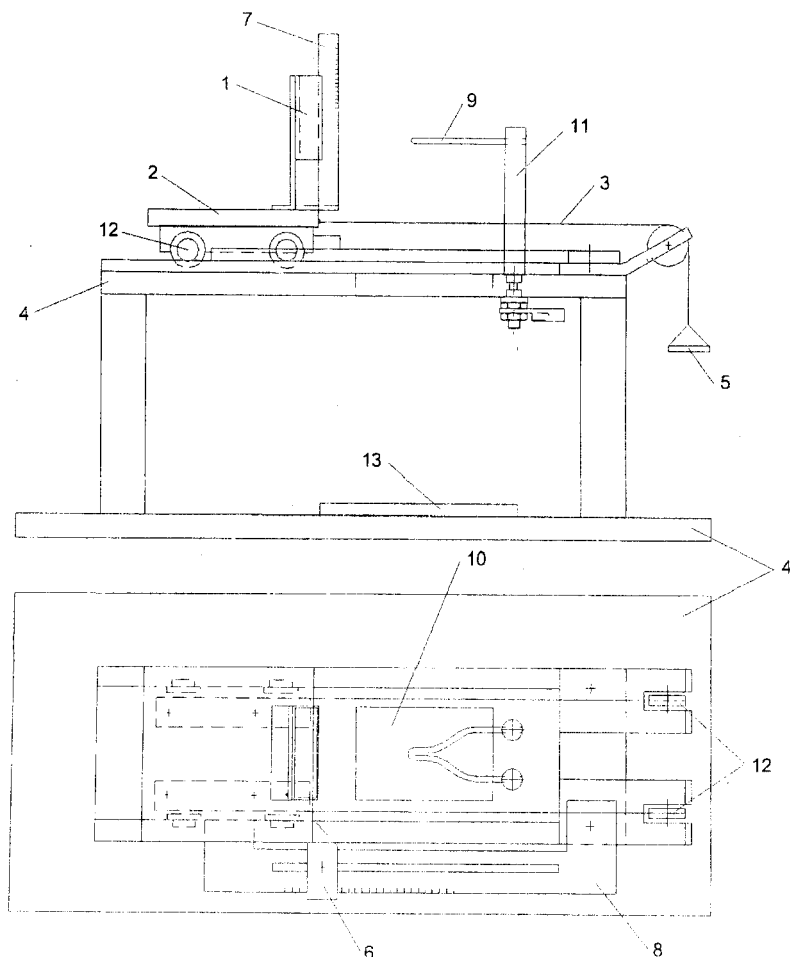


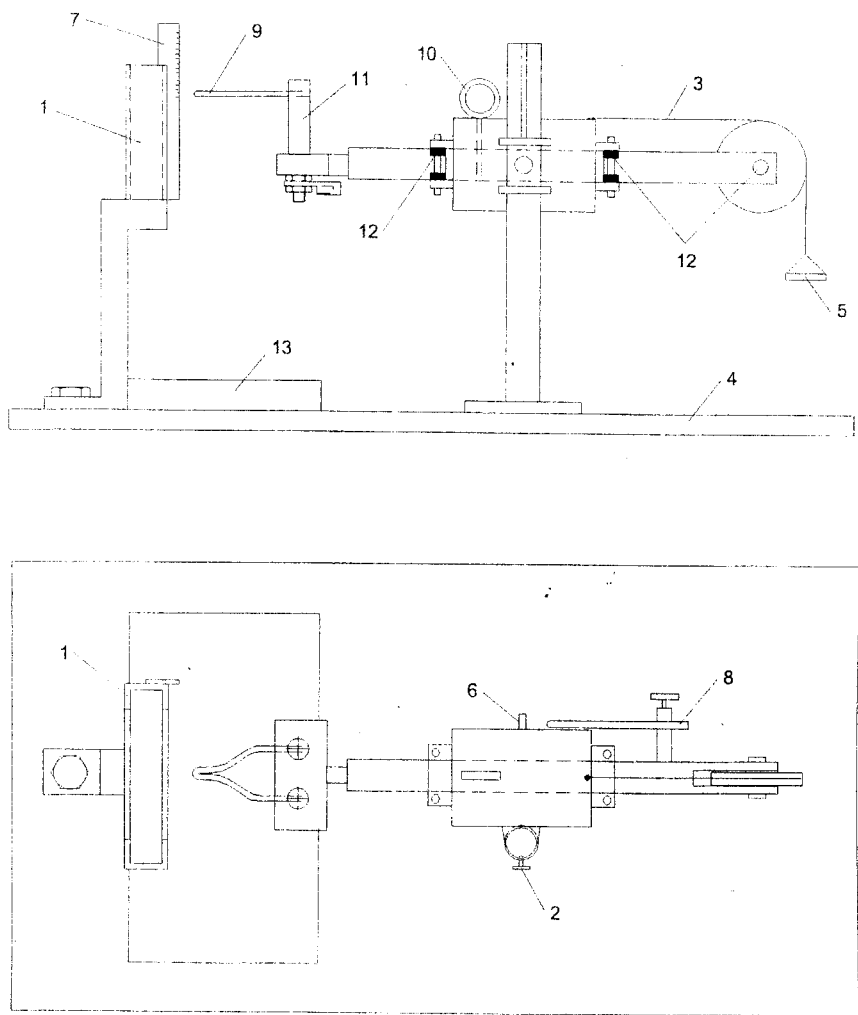
Figure 2 – Test circuit



Key

- | | |
|--|--|
| 1 Test specimen support (see figure 4) | 8 Penetration adjustment |
| 2 Carriage | 9 Glow-wire |
| 3 Tensioning cord | 10 Cut-out in base plate for falling particles |
| 4 Base plate | 11 Glow-wire mounting stud |
| 5 Weight | 12 Low-friction rollers |
| 6 Adjustable stop | 13 Specified layer |
| 7 Scale to measure height of flame | |

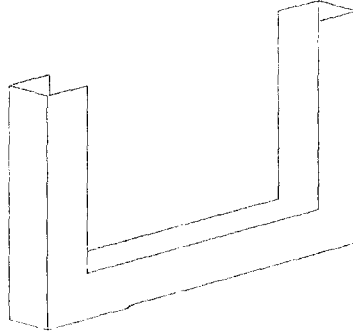
Figure 3a – Test apparatus (example)



Key

- | | | | |
|---|--------------------------------------|----|-------------------------|
| 1 | Test specimen support (see figure 4) | 8 | Penetration adjustment |
| 2 | Height adjustment screw | 9 | Glow-wire |
| 3 | Tensioning cord | 10 | Restraining pin |
| 4 | Base plate | 11 | Glow-wire mounting stud |
| 5 | Weight | 12 | Low-friction rollers |
| 6 | Adjustable stop | 13 | Specified layer |
| 7 | Scale to measure height of flame | | |

Figure 3b – Test apparatus (example)



This design proposed above is to ensure that thermal losses are insignificant.
No tolerances or dimensions are shown because it is an example only.

Figure 4 – Test specimen support (example – see figures 3a and 3b)

Annex A
(informative)

Glow-wire equipment manufacturers

An up-to-date list of glow-wire equipment manufacturers and suppliers is maintained by the Secretary of IEC technical committee 89 and by the IECEE-CTL. The coordinates of both these sources of information can be found in either the IEC Directory or in the IEC website:
<http://www.iec.ch>

(Continued from second cover)

Only the English language text of the International Standard has been retained while adopting it as an Indian Standard, and as such the page numbers given here are not the same as in the IEC Publication.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc: No. LITD 01 (3063).

Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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